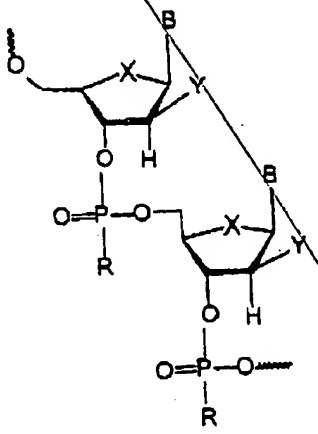
WHAT IS CLAIMED IS:

1. A composition to selectively prevent gene transcription and expression in a sequence-specific manner, which comprises an effective amount of at least one selected from the group consisting of an oligonucleotide consisting essentially of arabinose sugars hybridizing to a single stranded RNA to induce RNase H activity; an oligonucleotide consisting essentially of arabinose sugars hybridizing to duplex DNA/DNA or DNA/RNA to form a triple helical complex, in association with an acceptable carrier.

2. The composition of claim 1, wherein said oligonucleotide has the formula:




wherein,

B is selected from the group consisting of adenine, guanine, uracil, thymine, cytosine, inosine, and 5-methylcytosine;

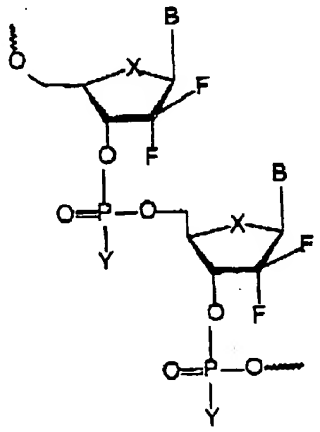
Y at the 2' position of the sugar ring is selected from the group consisting of a halogen (fluorine, chlo-

rine, bromine, iodine), hydroxyl, alkyl, alkylhalide (e.g., $-CH_2F$), alkylsulfhydryl ($-SCH_3$) allyl, amino, aryl, alkoxy, and azido;

R at the internucleotide phosphate linkage is selected from the group consisting of oxygen, sulfur, methyl, amino, alkylamino, dialkylamino (the alkyl group having one to about 20 carbon atoms), methoxy, and ethoxy; and

X at the furanose ring (position 4') is selected from the group consisting of oxygen, sulfur, and methylene ($CH_2$).

3. The composition of claim 1, wherein said oligonucleotide has the formula:




wherein,

B is selected from the group consisting of adenine, guanine, uracil, thymine, cytosine, inosine, 5-methylcytosine;

Y at the internucleotide phosphate linkage is selected from the group consisting of oxygen, sulfur, methyl, amino, alkylamino, dialkylamino (the alkyl group hav-

ing one to about 20 carbon atcms), methoxy, and ethoxy; and

X at the furanose ring (position 4') is selected from the group consisting of oxygen, sulfur, and methylene ($CH_2$).

4. The composition of claim 1 or 2, wherein said RNA is complementary RNA.

5. The composition of claim 4, wherein said complementary RNA is cellular mRNA or viral RNA.

6. The composition of claims 1-5, wherein said acceptable carrier is a pharmaceutically acceptable carrier for administration to a host.

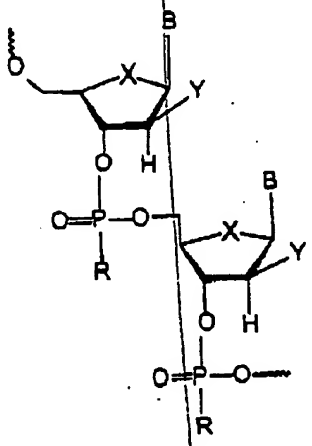
7. A method for cleaving single stranded RNA, which comprises the steps of:

a) hybridizing in a sequence specific manner an oligonucleotide consisting essentially of arabinose sugars to a single stranded RNA to induce RNase H activity; and

b) allowing said induced RNase H to cleave said hybridized single stranded RNA.

8. A method to inhibit DNA replication and/or DNA transcription, which comprises hybridizing in a sequence specific manner an oligonucleotide consisting essentially of arabinose sugars to duplex DNA/DNA or DNA/RNA to form a triple helical complex; thereby inhibiting DNA replication and/or DNA transcription.

9. The method of claim 7 or 8, wherein said oligonucleotide has the formula:



wherein,

B is selected from the group consisting of adenine, guanine, uracil, thymine, cytosine, inosine, and 5-methylcytosine;

Y at the 2' position of the sugar ring is selected from the group consisting of a halogen (fluorine, chlorine, bromine, iodine), hydroxyl, alkyl, alkylhalide (e.g., $-CH_2F$), alkylsulfhydryl ($-SCH_3$) allyl, amino, aryl, alkoxy, and azido;

R at the internucleotide phosphate linkage is selected from the group consisting of oxygen, sulfur, methyl, amino, alkylamino, dialkylamino (the alkyl group having one to about 20 carbon atoms), methoxy, and ethoxy; and

X at the furanose ring (position 4') is selected from the group consisting of oxygen, sulfur, and methylene ($CH_2$).

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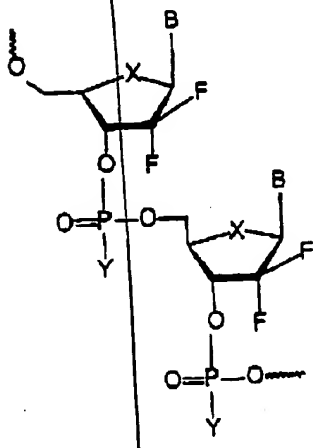
10. The method of claim 7 or 8, wherein said oligonucleotide is



wherein,

B is selected from the group consisting of adenine, guanine, uracil, thymine, cytosine, inosine, 5-methylcytosine;

Y at the internucleotide phosphate linkage is selected from the group consisting of oxygen, sulfur, methyl, amino, alkylamino, dialkylamino (the alkyl group having one to about 20 carbon atoms), methoxy, and ethoxy; and

X at the furanose ring (position 4') is selected from the group consisting of oxygen, sulfur, and methylene ($CH_2$).

11. The method of claim 7 or 8 wherein said oligonucleotide is chemically modified at least at one site with a ligand or a pharmacological agent to enhance at least one of: (i) permeability of said oligonucleotide into cells, (ii) nuclease stability, or (iii) binding strength of hybridization to complementary sequences.

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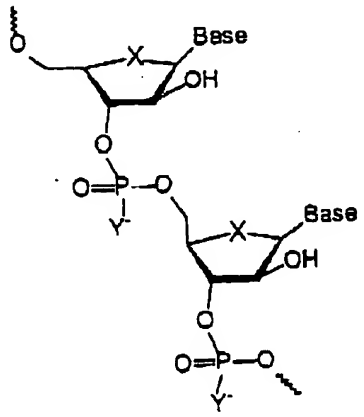
12. The method of claim 11, wherein the ligand is a cell surface receptor, at least one L-sugar residue, a 3'-to-3' linked nucleotide, at least one 2-O-methyl-D-ribose sugar.

13. The method of claim 7, wherein said RNA is complementary RNA.

14. The method of claim 13, wherein said complementary RNA is cellular mRNA or viral RNA.

~~15.~~ A method for selectively cleaving RNA, which comprises selectively hybridizing an oligonucleotide consisting essentially of β-D-arabinofuranose nucleotide units to RNA without hybridizing to single stranded DNA in a sequence specific manner, said oligonucleotide has the formula:




wherein said oligonucleotide has a mixed base composition;

wherein,

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B is selected from the group consisting of adenine, guanine, uracil, thymine, cytosine, inosine, and 5-methylcytosine;

Y at the internucleotide phosphate linkage is selected from the group consisting of oxygen, sulfur, methyl, amino, alkylamino, dialkylamino (the alkyl group having one to about 20 carbon atoms), methoxy, and ethoxy; and

X at the furanose ring (position 4') is selected from the group consisting of oxygen, sulfur, and methylene ($CH_2$).

16. A method of catalyzing chemical reactions carried out by DNA enzymes, which comprises using the composition of claim 2.

17. The method of claim 7 or 8 wherein said oligonucleotide is a chimera of at least one ANA oligonucleotide and at least one 2'F ANA oligonucleotide to enhance at least one of: (i) permeability of said oligonucleotide into cells, (ii) nuclease stability, or (iii) binding strength of hybridization to complementary sequences.

~~18~~. An oligonucleotide for selectively preventing gene transcription and expression in a sequence-specific manner in a host; which comprises an oligonucleotide consisting essentially of arabinose sugars hybridizing to a single stranded RNA to induce RNase H activity; an oligonucleotide consisting essentially of arabinose sugars hybridizing to duplex DNA/DNA or DNA/RNA to form a triple helical complex; and at least one 2-O-

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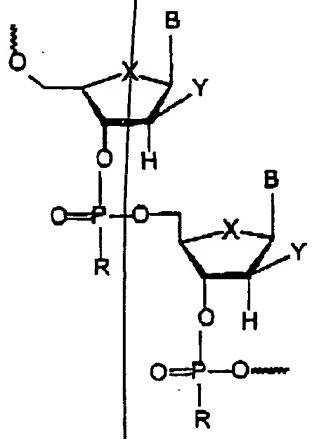
methyl-D-ribose sugar at 3', 5' or both terminus of said oligonucleotide.

19. The oligonucleotide of claim 18, wherein said oligonucleotide has the formula:




wherein,

B is selected from the group consisting of adenine, guanine, uracil, thymine, cytosine, inosine, and 5-methylcytosine;

Y at the 2' position of the sugar ring is selected from the group consisting of a halogen (fluorine, chlorine, bromine, iodine), hydroxyl, alkyl, alkylhalide (e.g., $-CH_2F$), allyl, amino, aryl, alkoxy, and azido;

R at the internucleotide phosphate linkage is selected from the group consisting of oxygen, sulfur, methyl, amino, alkylamino, dialkylamino (the alkyl group having one to about 20 carbon atoms), methoxy, and ethoxy; and

X at the furanose ring (position 4') is selected from the group consisting of oxygen, sulfur, and methylene ($CH_2$).

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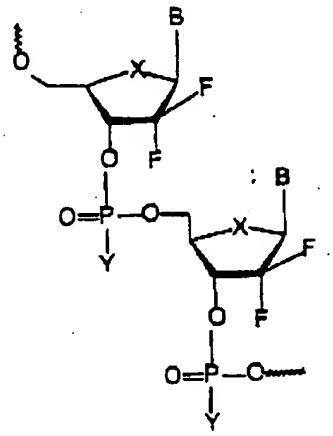
20. The oligonucleotide of claim 18, wherein said oligonucleotide has the formula:



wherein,

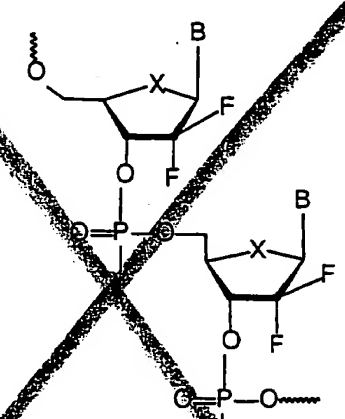
B is selected from the group consisting of adenine, guanine, uracil, thymine, cytosine, inosine, 5-methylcytosine;

Y at the internucleotide phosphate linkage is selected from the group consisting of oxygen, sulfur, methyl, amino, alkylamino, dialkylamino (the alkyl group having one to about 20 carbon atoms), methoxy, and ethoxy; and

X at the furanose ring (position 4') is selected from the group consisting of oxygen, sulfur, and methylene ($CH_2$).

X at the furanose ring (position 4') is selected from the group consisting of oxygen, sulfur, and methylene ($CH_2$).

20. The oligonucleotide of claim 18, wherein said oligonucleotide has the formula:



wherein,

B is selected from the group consisting of adenine, guanine, uracil, thymine, cytosine, inosine, 5-methylcytosine;

Y at the internucleotide phosphate linkage is selected from the group consisting of oxygen, sulfur, methyl, amino, alkylamino, dialkylamino (the alkyl group having one to about 20 carbon atoms), methoxy and ethoxy; and

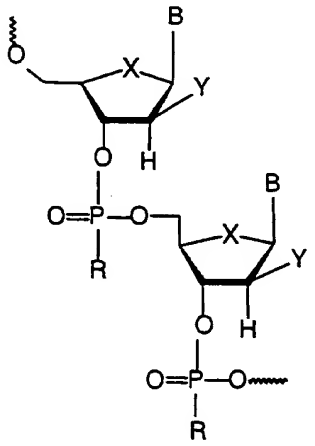
X at the furanose ring (position 4') is selected from the group consisting of oxygen, sulfur, and methylene ($CH_2$).

21. The use of an oligonucleotide consisting essentially of arabinose sugars for the preparation of a medicament for cleaving single stranded RNA, wherein said oligonucleotide hybridizes in a sequence specific

manner to a single stranded RNA to induce RNase H activity in cleaving said hybridized single stranded RNA.

22. The use of an oligonucleotide consisting essentially of arabinose sugars for the preparation of a medicament to inhibit DNA replication and/or DNA transcription, wherein said oligonucleotide is substituted at 2' position of the sugar ring other than with a hydroxyl and hybridizes in a sequence specific manner to duplex DNA(Py)/DNA(Pu) or DNA(Pu)/RNA(Pyr) to form a triple helical complex; thereby inhibiting DNA replication and/or DNA transcription.

23. The use of claim 21 or 22, wherein said oligonucleotide has the formula:




wherein,

B is selected from the group consisting of adenine, guanine, uracil, thymine, cytosine, inosine, and 5-methylcytosine;

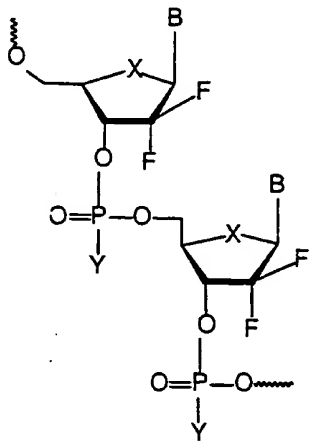
Y at the 2' position of the sugar ring is selected from the group consisting of a halogen (fluorine, chlorine, bromine, iodine), alkyl, alkylhalide (e.g., -

$CH_2F$), alkylsulfhydryl ($-SCH_3$), allyl, amino, aryl, alkoxy, azido, and hydroxyl when said oligonucleotide hybridizing to single stranded RNA;

R at the internucleotide phosphate linkage is selected from the group consisting of oxygen, sulfur, methyl, amino, alkylamino, dialkylamino (the alkyl group having one to about 20 carbon atoms), methoxy, and ethoxy; and

X at the furanose ring (position 4') is selected from the group consisting of oxygen, sulfur, and methylene ($CH_2$).

24. The use of claim 21 or 22, wherein said oligonucleotide is



wherein,

B is selected from the group consisting of adenine, guanine, uracil, thymine, cytosine, inosine, 5-methylcytosine;

Y at the internucleotide phosphate linkage is selected from the group consisting of oxygen, sulfur, methyl, amino, alkylamino, dialkylamino (the alkyl group having one to about 20 carbon atoms), methoxy, and ethoxy; and

X at the furanose ring (position 4') is selected from the group consisting of oxygen, sulfur, and methylene ($CH_2$).

25. The use of claim 21 or 22, wherein said oligonucleotide is chemically modified at least at one site with a ligand or a pharmacological agent to enhance at least one of: (i) permeability of said oligonucleotide into cells, (ii) nuclease stability, (iii) binding strength of hybridization to complementary sequences, or (iv) cleavage of target RNA by RNase H.

26. The use of claim 25, wherein the ligand is a cell surface receptor, at least one L-sugar residue, a 3'-to-3' linked nucleotide, at least one 2-O-methyl-D-ribose sugar.

27. The use of claim 21, wherein said RNA is complementary RNA.

28. The use of claim 27, wherein said complementary RNA is cellular mRNA or viral RNA.

29. The use of a composition of claim 2 for catalyzing chemical reactions carried out by nucleic acid enzymes.

30. The use of claim 21 or 22, wherein said oligonucleotide is a chimera of at least one ANA nucleotide unit and at least one 2'F ANA nucleotide unit to enhance at least one of: (i) permeability of said oligonucleotide into cells, (ii) nuclease stability, or

(iii) binding strength of hybridization to complementary sequences.